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Effect of Mesh Openings with Hybrid (Glass&Recron) Fibers on Mechanical Properties of Ferrocement Elements

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ABSTRACT

The cracking stress, Ultimate moment, Shear Strength, First crack moment, First crack Load and corresponding Deflection of ferrocement elements in shear and flexure are the significant parameters in the design of structures made of ferrocement elements. In this project I am going to presents an experimental investigation on ferrocement elements uniformly reinforced by three different meshes, such as Hexagonal mesh, Diamond mesh, square mesh with Hybrid fibers of 1%, 2% and 3% of Glass fiber and Recron fibers. In this paper I would like to study the cracking Stress, Ultimate moment, shear strength and deflection properties of ferrocement elements by analyzing experimental data, the equations for the first- crack-stress, ultimate-moment and volume fraction have to made in this paper. Results obtained by the proposed equations have to be compared to those reported in the literature.For ferrocement and laminated cementitious composites, increasing number of mesh openings have to cast and bending test is going to conduct on those specimens. Ferrocement members can be used in the form of plates Such as for walling unit, marine structures etc. Such plates are subjected to shear buckling hence shear resistance capacity of plate need to be verified. Various authors have studied shear behaviour on different specimens such as box beams, panels, and plates. In the present study an attempt is made to observe behavior of ferrocement rectangular plate with various mesh patterns.

Keywords: Ferrocement, Cracking stress, Bending Moment, Flexural behavior Shear Behaviour of Ferrocement Plates (SBFP), ultimate load-deflection and meshes.

I. INTRODUCTION

Generally conventional reinforced concrete members are too heavy, brittle cannot be satisfactorily repaired if any damage develops cracks or reinforcement corrodes. The above disadvantages of normal concrete forced the use of Ferro cement concretes. Ferrocement techniques though of recent origin have been extensively used in many countries. There is a growing awareness of the advantage of this technique of construction all over the world. Ferrocement is a composite material constructed by cement mortar reinforced with closely spaced layers of wire mesh and 1%, 2%, 3% of Glass and Recron type Hybrid fibers. The ultimate tensile resistance of ferrocement is provided solely by the reinforcement in the direction of loading. The compressive strength is equal that of the unreinforced mortar. However in case of flexure or shear analysis and design of ferrocement elements are complex and are based primarily on the reinforced concrete analysis using principle of equilibrium and compatibility

II. PRESENT STUDY AND OBJECTIVE

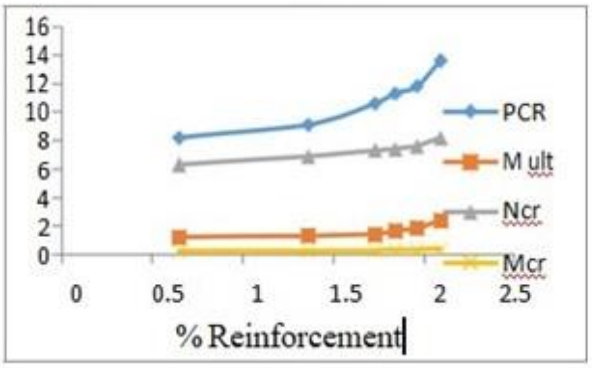
The study is also carried on the experimental and analytical investigations of the ultimate moment capacity and the ultimate shear capacity of the plate with size of 500x150x30mm. The mode of failures and the crack patterns were also observed. Variables chosen for the investigation were the single layers of mesh with different openings and shear span to depth (a/d) ratio with 1 to 3% of individual and hybrid Glass and Recron fibers. For ultimate moment capacity shear intensity, bending and cracking stress analysis by trial and error methods based on the principles of equilibrium and strain compatibility were used. Both methods have produced satisfactory results.The variation of shear force with a/d ratio along with different fiber percentages of single layer with two opening of mesh is examined. The experimental ultimate shear is compared with different code values (viz., AC1, BS, AC, and lS). The variation of ultimate moment of resistance and experimental shear is also examined with respect to volume fraction to and a/d. ratios. The variation of ultimate shear to the shear strength vcr is observed with reference to volume fraction and different types of steel meshes are used. Those are Square mesh with 1,2mm and Hexagonal mesh with 4, 6mm and Diamond mesh with 8, and 12mm opening meshes are used in this present project.

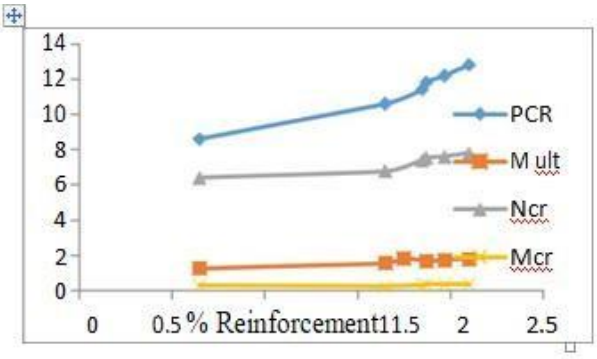
III. MATERIALS USED

Ordinary Portland cement giving a 28days mortar (1:3) compressive strength of 53MPa and fine aggregate confirming to the requirements of ASTM-C-33 was used in the entire investigation. Steel square mesh, Hexagonal and Diamond mesh was used as reinforcement to the Ferro cement rectangular elements. The diameter of wire was found to be 0.56mm, 1.0mm and 1.5mm. The openings in the mesh are 1mm x 1mm, 2x2mm for square mesh and 4x4mm & 6x6mm for Hexagonal mesh and 8x8mm & 12x12mm opening for Diamond mesh. The ultimately highest yield strength was observed in hexagonal wires of the mesh was found to be 370Mpa, A cement Sand ratio of 0.50 and a water cement ratio 0.45 were used for casting the units. Ferro cement control specimens of rectangular plate size 500x150x30mm for shear and flexure test with 1,2,3% of hybrid fibers like glass and Recron fibers of specimens for flexural test were also cast along with the test units. The compressive strength of the mortar found to be 35Mpa. The constituent materials of ferrocement are cement, sand, water, steel reinforcement, glass and recron.

IV. RESULTS AND DISCUSSIONS

Square mesh with 2mm opening specimens





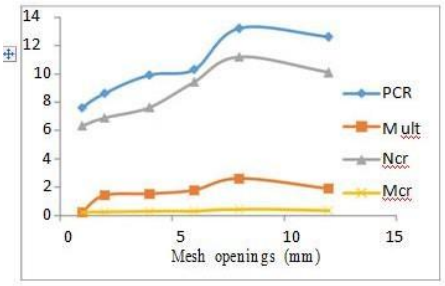
Diamond mesh with 8mm opening specimens.

Hexagonal mesh with 6mm opening specimens

GROUP-B

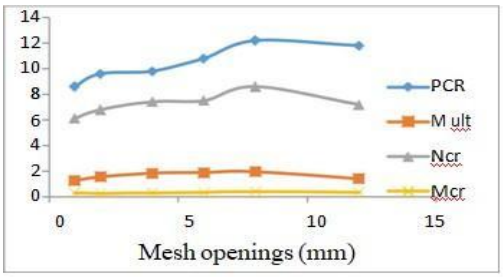
By the effect of mesh opening with three mesh types varies the shear and flexural parameters like Ncr, Mult, Pcr and Mcr. But Hexagonal mesh 6mm

opening specimens gives the best results shown in below:



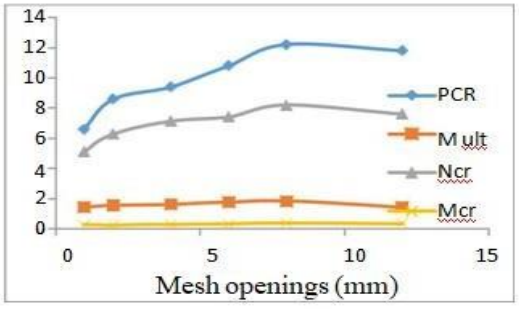
Hexagonal mesh opening of plate specimens

Diamond mesh opening of plate specimens



Finally, from the above all graphs shows the first crack moment, ultimate moment, cracking stress and cracking load with effect of percentage of reinforcement and mesh openings. In this 3% of hybrid fibers of hexagonal 6mm mesh of specimens are the best results obtained. Finally, from the bending and shear results we observed following issues discussed below Finally, by using 1%,2% and 3% of hybrid fibers like glass and recron fibers in the ferrocement plate mortar matrix the optimum value is 3% of glass and recron fibers specimen gives the 50% of results when compared to remaining fiber percentages of plate 500x150x30mm size of plate.

V. CONCLUSION



Square mesh of 2mm plate specimens

Based on the results and observations of the experimental, the analytical study presented in this thesis and considering the relatively high variability and the statistical pattern of data. The main purpose of the present work, to check the suitability of cracking stress, ultimate moment, shear strength, first crack load, ultimate load, volume fraction and corresponding deflection of the ferrocement rectangular plate elements. From the results of number of Ferrocement specimens tested and some conclusions can be drawn as follow:

1. The cracking loads slightly increased as the reinforcement volume fraction increased and the cracking loads were dependent on the mesh type and opening of the mesh.
2. The Flexural capacity of the composite plates increased with the increase of the specific surface area of the mesh.
3. The shear and flexural capacity of plates should be increased with increases the percentages of hybrid fibers 1, 2 and 3% of glass and recron fibers.
4. The rate of increase of both the cracking stress and ultimate bending moment are maximum for ferrocement contains Hexagonal mesh and are the least for the square mesh.
5. The load at which the load-deflection relationship started to deviate from the linearity and the extent of the plastic deformation varied with the type of steel mesh in the ferrocement plates.
6. One of the main advantage of ferrocement plates is that it can constructed with low cast housing compared to R.C.C structures.
7. And it decreases the self weight up to 20-40%. so, ferrocement structures can be used in minor structures.
8. The proposed equations for the first crack stress, first crack moment and ultimate moment of the flexural ferrocement elements are simple but provide reasonably accurate results as compared to relatively more complicated equations

involving many parameters.

9. Flexural first crack stress, first crack moment and ultimate moment increased with the increase in percent effective reinforcement for any type of meshes.
10. For the ferrocement plates with light weight mortar under flexural loading, increasing the number of openings leads to an increase in the ultimate load, cracking stress, cracking moment and corresponding deflection.
11. From the results ultimate values for hexagonal mesh of 6mm opening mesh with 3% of hybrid fibers like Glass and Recron fibers when compared to conventional ferrocement rectangular plate.
12. With this results we conclude that if volume fraction increases the shear intensity of plate also increases and it depends upon the opening and thickness of mesh.
13. If increase the opening of the mesh cracking stress, cracking and ultimate moment and ultimate load-deflection increases with increase of addition of hybrid fibers with different percentages like Glass and Recron fibers.
14. Finally, we increase the effective % reinforcement and opening of the mesh to increases the first crack stress, first crack moment, ultimate moment, first crack load and shear strength. But in this project we got the ultimate results for hexagonal mesh 6mm(KB2) opening of mesh with 3% of hybrid fibers like glass and recron fibers of rectangular ferrocement plate element.
15. From this results we conclude that the ferrocement structures are cost effective and light weight structures when compared to R.C.C structures. Because, in this ferrocement plates mortar matrix was used there is no coarse aggregate content. So, it is in light weight and also it should be satisfy the strength parameters.

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